Title
Electrochemical Recycling of CO_2

Abstract
Carbon dioxide (CO_2) is a molecule that plays multiple roles in our universe. Currently, its impact on global warming has rightfully given CO_2 a label as a harmful waste product that must be amply handled. Nonetheless, under other circumstances, and from other perspectives, CO_2 could be regarded as a valuable resource. As example, in nature CO_2 is an essential building block in photosynthesis ultimately yielding molecules and materials that we harvest for numerous applications ranging from energy storage and construction to medicines and food. In a similar manner, there is a growing interest to utilize atmospheric CO_2 to generate renewable fuels and platform chemicals through artificial processes. These processes can replace fossil-based industrial processes on earth alleviating climate impact, but they can also find uses far away from our planet. In space, CO_2 is an important source of precious oxygen, however, it can also serve as feedstock for carbon-based molecules and materials that are needed to sustain societies at distant planets such as Mars. In this presentation, I will discuss the contemporary understanding of electrochemical reduction of CO_2 for selective production of desired molecules. We will zoom in to the very atomic scale to gain mechanistic understanding of how the structure and composition of the cathode electrode affects product distributions. This information is used as guide in the design of new materials that convert CO_2 more efficiently and more selectively. On this basis, opportunities for recycling CO_2 under different conditions will be discussed, as will remaining challenges for the ultimate application towards the sustainable human living on earth and in space.

Speaker bio:
Joakim Halldin Stenlid holds a position as Computational Materials Scientists at NASA and KBR Inc. at the NASA Ames Research Center. He received a Ph.D. and M.Sc. in Chemical Engineering from KTH Royal Institute of Technology in Sweden, and has postdoctoral experience from Stockholm University and Stanford University. His Ph.D. thesis received the Inga Fischer-Hjalmars award in 2017. In his early career, Dr. Stenlid modeled copper corrosion as part of the evaluation of copper as encapsulation material for the disposal of spent nuclear fuel. Lately, his research has focused on developing theoretical models for describing heterogeneous (electro)catalysis with applications in renewable processes for production of sustainable fuels and chemicals. At NASA, Joakim works on development of the next generation batteries for electric aviation as well as on electrochemical conversion of CO_2.